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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D. C.

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In the Matter of	)	
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Telecommunications Services	)	CS Docket No. 95-184
Inside Wiring	)	
	)	
Customer Premises Equipment	)	

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COMMENTS OF GENERAL INSTRUMENT CORPORATION

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General Instrument Corporation ("GI") submits these comments in response to the Notice of Proposed Rulemaking ("NPRM") in the above-captioned proceeding, FCC 95-504, released January 26, 1996. GI's comments focus on two topics: 1) cable signal leakage and the need for technical standards for cable; and 2) customer premises equipment and whether it is appropriate to require a Part 68-like regulatory regime for cable TV equipment.

I. Summary of Position

The Commission should not apply Part 68 and *Computer Inquiry* regulations to cable systems or to advanced broadband networks now under development. Although Part 68 and *Computer Inquiry* regulations have been useful to the competitive development of telecommunications networks, that regulatory scheme has limitations which make it particularly inappropriate here. As interpreted by the Commission, it does not apply to transmission equipment. Moreover, the differences between traditional telephone networks, cable television systems, and the advanced broadband networks which are evolving militate against its application. That regulatory scheme would be very damaging to the development of new communications technologies if the Commission were to freeze, or even attempt to freeze those technologies prematurely, as would be the case if Part 68 and the *Computer Inquiry* regulations were applied in their present form. It is simply too soon to reach conclusions on the optimal methods of delivering cable services, particularly with the advent of new digital services.

When Part 68 and the *Computer Inquiry* rules were adopted, the telephone industry had been in existence for approximately 80 years, the technology was well understood relative to today's developing broadband and video transmission, customer equipment was standard and ubiquitous, one company served most of the nation, and that one company had already documented most of the specifications. None of that applies today with respect to broadband networks.

All this was recognized by the Congress which has stated its intention that Part 68 and *Computer Inquiry* regulation will not apply to open video platforms. Moreover, application of Part 68 would raise serious issues with respect to security and services based on interactivity.

While standardization may not be appropriate for rapidly evolving technologies, it can have a place where products have achieved more stability. That is the case with coaxial cable used for inside wiring of cable television networks, particularly where such cable is the source of signal leakage and consequent signal interference, and particularly where the concern about such leakage can affect services in aeronautical and other emergency frequency communications bands. For this reason, we propose that the FCC adopt the Society of Cable Telecommunications Engineers ("SCTE") standard for shielding of such cable, SCTE IPS-SP-001a.

II. Interests of GI and its Subsidiaries

General Instrument Corporation is a world leading supplier of technology and equipment for broadband communications systems. The General Instrument Communications Division is a leading supplier of networking and subscriber equipment to the cable television industry and the developer and supplier of digital compression technology and equipment for satellite and terrestrial networks. Next Level Communications is a subsidiary of GI and was founded in July of 1994 to develop a Fiber

To The Curb ("FTTC")[1] access system which can provide both broadband and narrowband services in an integrated and cost effective manner. The CommScope Division of General Instrument Corporation is the world leader in the manufacture of cable television coaxial cable and has been for more than twenty years. CommScope provides more than half the world's annual requirements for coaxial cable used in cable television.

III. Leakage and the Need for Cable Technical Standards

The Commission should adopt and enforce Sections 1 through 8 of IPS-SP-001a as a standard.

A major cause of cable signal leakage is inadequately shielded coaxial cable that is widely sold in consumer electronics retail stores. The industry has developed technical standards to deal with this problem but retailers continue to sell and consumers continue to buy cable that does not conform to the standards.

GI strongly supports the SCTE IPS specification for coaxial drop cable as the standard for in-home cabling of cable television systems for three very important reasons. First, SCTE IPS-SP-001a carefully defines shielding requirements for coaxial cable, and proper shielding is necessary to maintain RF integrity in the cable. Second, there is no national consumer standard for coaxial cable, as there is for building and telephone wire, and consumers often purchase substandard coaxial cable unknowingly. Cable conforming to the SCTE IPS-SP-001a standard is clearly preferable to the broad variety of inferior coaxial cables frequently available from discount outlets and consumer electronics stores. Third, SCTE IPS-SP-001a is an excellent standard, representing the

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[1] FTTC is frequently associated with switched digital video systems.

culmination of years of work by cable television operators and coaxial cable manufacturers to define the essential electrical and physical cable parameters. The SCTE took into account system performance needs, coaxial cable design, manufacturability, installation, safety, and craftsmanship.

Shielding is perhaps the most important element of the coaxial cable used inside the home. Poorly shielded cable allows signal leakage which presents problems not only within the home in which the leakage occurs, but can also cause the cable system to exceed Federal CLI limits. Excessive signal leakage can cause interference with services in aeronautical and other emergency communication frequency bands. A common and serious culprit in signal leakage problems is a subscriber-provided improperly shielded drop cable.

SCTE IPS-SP-001a defines at least two layers of shielding and as many as four layers. At a minimum, the first shielding layer is an aluminum/mylar/aluminum shield which is bonded with an adhesive to the dielectric of the coaxial cable. The aluminum/mylar/aluminum shield provides 100 percent shield coverage to prevent both signal ingress and egress. The bonding of the shield to the dielectric prevents the shield from slipping back when a connector is installed. The cable/connector interface is a frequent source of signal leakage in unshielded and/or non-bonded cables. In addition, SCTE IPS-SP-001a defines a minimum percentage overlap in the first shielding layer. Use of a bonded shield and proper overlap eliminates virtually all signal leakage from the coaxial cable. Unfortunately, coaxial cable typically available to the consumer rarely has the critical first layer of shielding. If the consumer is fortunate enough to find coaxial cable with an aluminum/mylar/aluminum shield, the shield is typically not bonded and does not provide sufficient overlap.

The second shield prescribed by SCTE IPS-SP-001a is an aluminum braid providing a minimum of 60 percent braid coverage. The braid shield provides additional shielding as well as mechanical strength to the shield and cable. Coaxial cable typically available through discount outlets and consumer electronics stores has braid coverage of 40 percent or less, further reducing the overall shield effectiveness and mechanical strength of the coaxial cable.

In summary, SCTE IPS-SP-001a is an important document for defining the electrical and mechanical performance of coaxial cable used inside the home. For the above stated reasons, the Commission should adopt and enforce Sections 1 through 8 of IPS-SP-001a as a standard because it will benefit both the consumer and the video service provider by ensuring viewing quality and system performance.

IV. Broadband Local Loop Technologies

The Commission should not apply CPE requirements to network transmission equipment in broadband cable networks.

There are major technological changes coming in the architecture of broadband communications networks provided by cable TV companies and by networks provided by common carriers.[2] These developments could be stifled by regulatory policies that deprive the network operators of the flexibility to deploy network components in a

2 See *infra*, p 24.

manner that is technically and economically efficient. In particular, the Commission's long-standing policies on customer premises equipment, if interpreted to also cover network transmission equipment, could deprive common carrier operators of the ability to locate network equipment inside the customer's premises. This would be a case of nomenclature substituting for analysis. For common carriers, and for cable systems, the important issue is function, not location alone.

Telecommunications local loop transmission technology will change dramatically over the next 5-10 years with the introduction of advanced broadband networks. Transmission technologies will include Fiber to the Curb (FTTC), with both twisted pair and coaxial drop cables; Hybrid Fiber/Coaxial Cable (HFC); Asymmetric Digital Subscriber Loop (ADSL); Very high-rate Asymmetric Digital Subscriber Loop (VDSL); and wireless technologies (e.g., MMDS, LMDS). Combinations of the above technologies will be employed to provide both traditional and new integrated telecommunications services.

Technical and economic efficiency will dictate that active devices be located not only near the demarcation point (e.g. outside of the home, inside the basement, or in a wiring closet), but also throughout the premises. These active devices will provide the interface between the local loop access system and the residential wiring or CPE device. These network interface devices, while located within the premises, should not be considered CPE, since they will frequently contain network transmission functions and should be operated and maintained by the network operator. Moreover, they will contain functionality which is access system specific, so that a unit designed for one technology may not work with a different technology.

FTTC network technologies will provide the basis for many advanced broadband services including Switched Digital Video and high speed Internet connectivity, as well as supporting traditional telephony services. For this advanced architecture, the last active device is at the curb, outside the premises, and signals on the drop cable to the subscriber are dedicated to that subscriber rather than shared among multiple subscribers. Consequently, for FTTC, while privacy remains a concern, such systems are not inherently vulnerable to theft of service.

That is not the case with Hybrid Fiber Coax ("HFC") network technologies which will play an important role because they have a lower infrastructure cost than FTTC. HFC networks are widely deployed (63 million current home connections) and inherently support broadband services. But in these HFC broadband networks the signals are shared in that typically all signals are delivered to (and within) each home, whether or not those signals have been purchased by that subscriber. Network owned and operated equipment at the residence provides the needed security to limit reception to only those signals which are authorized. That security may be at the demarcation point and/or within the premises as well.

V. Regulation as Customer Premises Equipment

A. *Congressional Intent*

The Commission's intent in this proceeding is evidently to harmonize the regulatory policies applicable to cable TV systems and common carrier video systems, by applying existing telecommunications common carrier policies to new equipment used with common carrier and cable TV networks. NPRM, para. 73. The Commission should not apply Part 68 and *Computer Inquiry* regulations to cable systems, because to do so would be counter to the intent expressed by Congress in the Telecommunications Act of 1996, an intention consistent with the flexible and innovative solutions now under consideration by network operators and their suppliers. Thus, rather than moving toward similar regulatory treatment for all providers, such application could perpetuate different regulatory schemes, even as the systems evolve toward each other.

The Commission adopted the NPRM prior to enactment of the Telecommunications Act of 1996. In passing the 1996 amendments, Congress spoke to the desirability of applying Part 68 and Computer Inquiry regulations to video networks. Congress recognized that in some circumstances the Part 68 and *Computer Inquiry* regulations have had a rigid, stifling effect on common carriers. Thus, Congress prohibited the Commission from applying such rules to "open video systems".

> "Section 302(b)(3) of the conference agreement specifically repeals the Commission's video dialtone rules. Those rules implemented a rigid common carrier regime, including the Commission's customet premises equipment and Computer III rules, and thereby created substantial obstacles to the actual operation of open video systems." Joint Explanatory Statement of the Committee of Conference, at Section 653(c)(3).

In light of this recognition and stated Congressional intention, it is clear that the Commission should not impose a Part 68-like regulatory regime on cable systems, and must amend Sections 64.702 and 68.2 to clarify that these policies and rules are no longer applicable to open video systems.

B. *Part 68 Regulations and Computer Inquiry Rules*

The Commission should not apply Part 68 Regulations and *Computer Inquiry* rules to cable system in-home hardware because much of that hardware is transmission equipment, not consumer premises equipment, and because cable systems are technically quite different from telephone systems.

The Commission has suggested that the telephone regulatory regime of Part 68 may be appropriate for cable networks. We disagree. The Part 68 rules and *Computer Inquiry* policies apply to Customer Premises Equipment, a category which includes terminal equipment but not network transmission equipment located at customers' premises. The distinction is critical, and it counsels strongly against applying a regime similar to Part 68 to cable equipment.

Moreover, with respect to CPE, the following subsections show that, first, there are substantial technical differences between the telephone systems of the 1970s and the cable systems of today; thus, any "lessons" learned from the implementation of Part 68 are inapplicable to cable networks. A much longer transition period would be needed to implement a Part 68-like regime for cable than was needed for telephone equipment. Second, while Part 68 standards may have stimulated competition in telephone equipment, in some instances they may have stifled innovation. Since the telephone industry of the 1970s was not enmeshed in anything like the massive changeover from analog to digital video that is now the major focus of the cable industry, innovation was not then a major factor; today it must be a central issue for all regulatory policies. Third, the *Computer Inquiry* requirement that carriers disclose their interface technology would, if applied to cable systems, surely degrade system security. Finally, all cable security systems in use today employ proprietary technology, and the Commission does not have the authority to mandate the use of proprietary technologies as part of a Part 68-like regime. Rather, it must rely on the voluntary offering of such technologies by its owners and the establishment of reasonable licensing fees.

1. *CPE Policies Do Not and Should Not Apply to Network Transmission Equipment*

Telephone *terminal equipment* located on customers' premises is unregulated and may not be offered by common carriers as part of a regulated service. However, as the Commission determined in implementing terminal equipment deregulation, *transmission equipment* located on customers' premises need not be treated as unregulated Customer Premises Equipment but may be regulated as part of the network transmission service.

The same result should obtain with respect to cable equipment: Functionality rather than physical location should determine regulatory categories and obligations. Regulation based on location would distort and introduce inefficiencies into the complicated world of broadband networks to a greater extent than in the relatively simple world of traditional telephone networks.

A review of the Commission's *Computer Inquiry* decisions shows that the Customer Premises Equipment policies were established in an environment where new CPE offerings were starting to contain memory, processing power and other features resembling computers. The purpose of the Computer Inquiry proceedings was to establish regulatory policies for telecommunications services without regulating computer services. The first proposal was to deregulate only CPE that provided more than a basic media conversion function, but the Commission decided that such a classification scheme would be unworkable. Consequently, the Commission decided to deregulate all CPE. *Final Decision in Second Computer Inquiry*, Docket No. 20828, 77 FCC 2d 384 (1980) at para.

8. CPE includes all terminal equipment located at a subscriber's premises which is connected with the termination of a carrier's communications channel at the network interface at that subscriber's premises. *Id.* at footnote 10. However, the Commission explicitly excluded from CPE "multiplexing equipment to deliver multiple channels to the customer." *Id.* at footnote 57.

Technology at that time appeared to provide a clean separation between CPE and the transmission functions of the telephone network. "We conclude that CPE is a severable commodity from the provision of transmission services." *Id.* at para. 9.

One particular test is whether the equipment located at a customer's premises is under the customer's control or under the carrier's control. If under the customer's control, it is CPE; if under the carrier's control, it is network transmission equipment. "Trends in technology enable CPE to function as an enhancement to basic common carrier services and many enhanced service applications involve interaction with sophisticated terminal equipment. The uses to which these devices may be put are under the user's, not the carrier's control." *Id.* at para. 160.

For voice telephone service at that time, there was no need to locate network transmission equipment at the customers' premises because each voice telephone circuit was delivered to a customer premises on a dedicated pair of wires, not on a shared transmission medium.

On reconsideration, the Commission focused on the boundary between CPE and transmission facilities in the case of satellite earth stations, and decided that network control equipment located at the customer's premises should not be treated as CPE. "We believe that [receive-only] stations are appropriately classified as CPE. Transmit earth stations that are located on the customer's premises present a different situation. In the offering of integrated satellite systems, such a transmit earth station could constitute a necessary component of the transmission offering for network control purposes. Accordingly, earth station equipment that requires licensing under Title III of the Act is not considered CPE under the Final Decision." *Computer II Reconsideration*, 84 FCC 2d 50 (1980) at para. 60.

In 1985, the Commission acted on a petition for declaratory ruling from Pacific Bell and determined that Digital Termination System subscriber stations should be classified as transmission equipment rather than CPE.

> "The DTS baseband unit is a component of a time division, multiple access system that permits users to transmit messages on specified radio transmission channels. Located on customers' premises, and only incidentally providing a multiplexing function, the baseband unit primarily ensures that subscribers occupy the correct system time slots. Thus, the baseband units provide the network control function for DTS. Unlike Network Control Terminating Equipment (NCTE), which serves as a terminal device connected directly to customers' wireline service, the baseband unit is used as an integral part of the point-to-multipoint radio DTS system. In short, we find that the baseband unit does not constitute CPE within the meaning of *Computer II*." *Memorandum Opinion and Order in Enf. File No. 84-58*, mimeo #6577, released August 22, 1985.
>
> "In conclusion, we find that the DTS baseband unit is not CPE. While it may offer a variety of functions, including delay equalization, interface termination, and loopback testing and multiplexing capability "to deliver multiple channels to the customer," its primary network control functions lead us to conclude that even when it is located on a customer's premises it is transmission equipment within the meaning of *Computer II* and our *NCTE Interconnection Order*." *Id.* at para. 17.

A Network Interface Unit in a two-way Hybrid Fiber Coax network would typically be responsible for receiving signals that are broadcast to all subscribers, for decryption of addressed messages and programs, for encryption of upstream messages, and for managing and controlling access to the shared upstream bandwidth. At least in this last regard, the NIU provides essentially the same network control functionality as the digital satellite earth stations and DTS units that the Commission determined to be transmission equipment rather than CPE. Moreover, like the satellite earth stations and DTS units, a HFC network is a radio network that involves RF transmission and reception (within the closed transmission medium rather than over-the-air). Whether the network operator locates this unit on the inside of the premises, to gain protection from the weather and access to electrical powering, or on the outside, to gain easy access for maintenance, should be a private decision of the network operator, not dictated by regulatory policies.

Encryption and decryption are also network transmission functions that are under the control of the network operator. This is consistent with the Commission's determination that it would not require cable systems to allow their subscribers to own descrambling equipment. *Cable Equipment Compatibility*, 9 FCC Rcd 1981 at para. 29.

In summary, it continues to be Commission policy that network transmission equipment located on customers' premises is appropriately regulated as part of the transmission service, not deregulated as CPE. But any specific element of hardware may have to be examined in detail to determine whether it is under the control of the network operator or the customer and whether it is network equipment or CPE.

2. *Technical Differences Between Telephone and Cable Networks*

When the Part 68 rules were adopted during the 1970s, the telephone industry was heavily committed to standardized technology and standardized operating procedures. Telephones that would work in one city would also work in other cities. That is not the case with the cable industry and cable boxes today. Thus, imposing a Part 68-like regulatory regime on cable would be extremely difficult, and could not be fully effective for many years.

The telephone industry during the 1970s was largely governed by the Bell System Practices, consisting of many shelves of loose leaf binders of standards documents. Smaller telephone companies conformed to technical standards issued by the Rural Electrification Agency. These standards covered all areas of telephone industry technology and practice. In particular, they covered the electrical specifications and signaling protocols that allowed telephone sets to communicate with central office switches. These particular standards formed the basis for Part 68.

In adopting Part 68, the Commission largely ratified existing telephone industry technologies and practices. But even in that case, the process took seven years.[3]

[3] Docket No. 19258 began in 1972 and finally concluded in 1979.

Chronology of FCC Actions Adopting Technical Interconnection Regulations for Telephone Terminal Equipment

June 6, 1972, Notice of Inquiry and Notice of Proposed Rulemaking in Docket No. 19258, 35 FCC 2d 539 (1972), to establish regulations for customer ownership of telephone terminal equipment
March 3, 1973, Supplementary Notice in Docket No. 19528, 40 FCC 2d 315 (1973)
November 7, 1975, First Report and Order in Docket No. 19528, 56 FCC 2d 593 (1975)
January 21, 1976, Public Notice announcing public meetings at FCC to discuss standard jacks and plugs

Cable systems are not comparably standardized. The apparently standard interface between cable systems and cable set top boxes is not sufficiently standardized to assure that a cable box intended for one city will work to receive scrambled programming in another city. While the connector is standardized (NPRM, para. 28), and the channel plan is standardized (EIA IS-132; see Section 76.605(a)(2) of the Commission's Rules), the signaling protocols that allow cable headends to send instructions to cable boxes are not standardized. This means that a cable converter intended for one city will be able to receive only unscrambled programming in another city.[4]

February 13, 1976, Reconsideration Order, 57 FCC 2d 1216 (1976)
March 15, 1976, Further Reconsideration Order, 58 FCC 2d 716 (1976)
March 18, 1976, Second Report and Order in Docket No. 19258, 58 FCC 2d 736 (1976)
April 12, 1976, Notice of Proposed Rulemaking in Docket No. 20774, 62 FCC 2d 735 (1976), to adopt standard jacks and plugs
July 12, 1976, Report and Order in Docket No. 20774, 62 FCC 2d 735 (1976)
June 20, 1977, Supplemental Notice of Proposed Rulemaking in Docket No. 19528, 64 FCC 2d 1039 (1977), to adopt interconnection standards for PBX and key systems
April 13, 1978, Third Report and Order in Docket No. 19528, 67 FCC 2d 1255 (1987)
February 5, 1979, Reconsideration Order in Docket No. 19528, 70 FCC 2d 1800 (1979)

Seven years is not an unusual length of time for FCC technical standards activities. For example, with cellular telephone service, the Commission began in 1968 with a proposal to allocate spectrum, and concluded in 1983 with court dismissal of an appeal of the cellular technical standards. With the direct broadcast satellite service, the Commission began with an allocation proceeding in 1978 and finally decided in 1986 not to adopt technical standards. Other standards proceedings dealing with the TV vertical blanking interval, satellite orbital spacing and other matters took comparable lengths of time.

[4] Consumers may today purchase cable converters that do not contain descrambling circuitry, and they may freely connect such converters to cable systems. But these converters cannot support services such as scrambled programming or pay-per-view services. See NPRM, para. 71.

While the telephone Part 68 standards process took seven years, the lesser degree of standardization in cable networks would make a cable industry standards process take even longer. Cable technology areas in which differences would have to be resolved include security, signal leakage, unswitched vs. switched network configurations, shared vs. dedicated network configurations, and the emerging evolution of digital video technologies in cable networks. In the face of rapid innovation, the likelihood is great that government standards setting processes will be outdated before their completion.

a. *Security and Video Scrambling*

Theft of service is a serious problem in both telephone and cable systems. Any cable standards process would need to take into account cable system security. The comparable element of telephone networks might be considered to be billing, and Part 68 contains a detailed set of requirements to protect billing records and protect against theft of service. See Section 68.314. In contrast, cable system security includes not only billing but also signal scrambling and control messages that are addressed to and processed by specific cable boxes. Cable systems today use a diverse set of technologies to scramble their programming. Standardizing that element would weaken security.

Given the differences in network design, security in wireline telephone networks is much easier to maintain and control than in cable systems. Telephone systems maintain communications control for each subscriber at the central office, by means of a dedicated switched signal path to each subscriber and a dedicated port on the central office switch. This signal path may be a dedicated pair of metallic wires, or a dedicated time slot or frequency slot in a multiplexed carrier transmission system. In contrast, a broadband cable system employs shared rather than dedicated bandwidth on the network, and shared program sources at the cable headend. This means a telephone customer can be disconnected (e.g., for non-payment) at the central office, but a cable customer must be disconnected at the drop wire. It means that telephone network access and authorization can be controlled at the central office, but cable access and authorization is controlled in the cable box. In an addressable cable network, the "switch" (i.e., to descramble or not) is essentially intrinsic to the box, triggered by control messages from the central cable headend. Thus, while telephones must comply with certain Part 68 technical rules to protect the integrity of the telephone billing system, the telephone carrier has control and verification capabilities at the central office. In contrast, many of the cable security "eggs" are in the cable box "basket," and the cable operator does not have the same level of control from the headend. While the telephone carrier can disconnect a subscriber from the central office, the cable operator must either send a control signal to the cable box, and hope that the subscriber has not tampered with or bypassed the box, or he can send a technician out to disconnect the drop wire.

A number of different technical methods are used to scramble analog TV signals in cable systems. The most common of these is "synch suppression" or "synch depression," a family of methods that includes suppressing the horizontal and/or vertical synch pulses by attenuating the RF envelope or shifting the baseband level prior to modulation. Synch information may be sent instead on the sound carrier or in the vertical interval. The offset time for sending the synch information may be varied randomly from one video field to the next, to add complexity and security.

Other analog scrambling methods include video inversion (subtracting a constant RF carrier at the same frequency and phase as the actual RF carrier), frequency inversion, video jitter (start time of each scan line is randomly varied), time reversal (some lines are transmitted in time-reversed manner); line dicing (each scan line is split into two fragments at a random point, and these fragments are interchanged prior to transmission); and permutation of video lines. Most scrambling systems today use combinations of two or more of these. Most systems are still evolving, as the network operators and equipment providers continue to attempt to stay at least one step ahead of the signal pirates.

These different methods offer different levels of security, at different costs. Simpler, less secure methods are often adequate in rural areas, for example, while big cities require more complex, sophisticated techniques. Moreover, because these methods differ from city to city, they deprive pirates and hackers of a single target. In contrast, the potential economic gain from breaking a single nationwide cable security standard would be enormously attractive to the signal pirate community, representing a huge "national" target.

Each manufacturer has designed custom integrated circuit ("IC") descramblers for each type of scrambling that it uses, and one of these custom ICs is part of the set top box circuitry. Under the control of the microprocessor in the box, when it receives the proper authorization message on the control channel, the custom IC will descramble the signal for which it was designed. Because of the wide variation in scrambling methods, one manufacturer's descrambling chip will typically not work with the scrambling system of a different manufacturer, and it will typically not work with a different scrambling method from the same manufacturer.

The Commission has recognized the risk of standardization and disclosure in connection with its proceeding on standardizing an encryption standard for satellite cable programming.

> "Moreover, we are convinced that a Commission standard-setting proceeding would be protracted, would diminish industry incentives to combat piracy, and could compromise the integrity of the standard adopted." *Report in Gen. Docket No. 89-78*, 5 FCC Rcd 2710 (1990), para. 71.

> "In any event, the cost of a standard in terms of limiting innovation incentives and possible compromise of anti-piracy efforts are compelling arguments against a standard." *Id.* at para. 72.

The same conclusions would apply to the standardization required by Part 68, perhaps with added emphasis since there are currently 68 million cable subscribers in the U.S., a very juicy target, while the Commission's conclusions against security standardization for the satellite industry in 1990 pertained to a total market of perhaps 2 million units at the time.

b. *Standardization of Control Signaling*

During the time of adoption of Part 68 rules, control signaling between the central office switch and the telephone set was accomplished by means of dial pulses and DTMF tones. Both methods were simple, well documented and in widespread use. In contrast, cable TV control signaling is done in a multitude of complex ways, and is not publicly documented. Both the diversity of methods and the lack of documentation serve to discourage piracy and enhance security.

There generally are two types of control signaling in use by "addressable" analog cable systems today.[5] Out-of-band data channels may carry the control signals. These are digital channels, often located on a frequency in or near the 88-108 MHz FM

[5] Non-addressable systems may use other methods, such as traps installed outside the home, to block access to unauthorized programming.

broadcast band. Alternatively, the control signals may be carried within the vertical blanking interval of one or more TV channels. In each case, the precise location and modulation method will vary from one manufacturer to another. Most systems use Frequency Shift Keying (FSK) modulation for the signal control, but some may use Phase Shift Keying (PSK) or Pulse Amplitude Modulation (PAM). Different error correction coding, bandwidths and data rates are used, as well. Even within models from a single manufacturer, the details may vary from one model to another. Because of the need to avoid interference from strong broadcast signals, the precise frequencies chosen for the out-of-band data channels may vary from one city to another.

The structure of the data within the control channel varies from one system to another. The precise layout is a closely held trade secret, for security reasons, in order to protect the authorization messages that control the operation of the descrambler. Manufacturers do not even provide the layout of the control channel to cable system operators/customers; even internally, within an addressable systems developer such as General Instrument, this information is available only on a need-to-know basis. If the control channel data layout were not so tightly controlled, it would easily be possible to design equipment to send false descrambling authorization messages to the set top box. This practice is justified on the basis of network security, but it is precisely contrary to the Computer Inquiry requirement in Section 64.702(d)(2) that telephone carriers make full disclosure of their network designs and technical standards.

Any public standardization process would require full and detailed disclosure of these details, and would thereby weaken signal security and provided valuable information for the pirate underground.

c. *Signal Leakage and Control*

Another significant technical difference between the telephone networks of the 1970s, when Part 68 was adopted, and today's cable systems, is signal leakage. Those telephone systems did not employ radio frequencies that were likely to interfere with licensed communications services if they leaked out of poorly wired customer premises.

Today, there is widespread use of low quality coaxial cable, and even non-coaxial cable, by cable customers who do their own internal wiring. This causes direct pickup interference that degrades picture quality. And when unwanted signals can leak in, there is the presumption that they can leak out.

The Commission's proceedings on telephone inside wiring did not have to deal with signal leakage issues. We believe that the Commission should, in this proceeding, adopt technical standards for customer premises coaxial cable to assure that adequately shielded cable is used in customer premise installations.[6] Moreover, the cable industry itself should develop a consumer information program to help subscribers understand the risks of direct pickup and signal leakage. GI stands ready to participate in that program, once technical standards for cable are adopted. Although today it is the indoor wiring rather than the set top box that presents the greatest risk of leakage, it may become necessary to reconsider the adequacy of the current Part 15 rules in an environment of widespread commercial availability.

[6] See *supra*, p. 5.

3. *Part 68 Regulation and Innovation*

Today's cable industry is currently in the process of conversion from analog to digital technology, and an explosion of new features and services is evident. Requiring standardized interfaces would interfere with competition among existing cable services and erect barriers to new services.

Amending Part 68 provisions requires a rulemaking proceeding. It typically takes the FCC about two years or more to adopt rule changes from the time a Petition for Rulemaking is filed.

The combination of Part 68's detailed technical specifications and the administrative difficulty in making changes to it would be constraining to the introduction of new technologies and services in cable networks. Indeed, examples of such constraining can be cited in telephone networks.

For example, many new PBX systems employ telephone sets that communicate with the PBX switch using digital control channel signals; this permits a variety of services that are based on digital networking, such as allowing a telephone set to change its identity so that a telephone number can follow an employee as he moves through the building. But these digital telephone sets cannot be connected directly to the telephone network, because their digital signals do not conform to Part 68. The PBX switch filters out the control channel and other digital signals before any calls are connected into the public telephone network.

Part 68 requires telephone sets to communicate with central office switches by means of "in band" signals, which simply means dialing a special sequence of characters and numbers. Instead of simply pushing a dedicated button on an advanced digital telephone set, as is the case with digital telephones used with private PBX networks, a public telephone network customer today must dial a special set of codes such as *70 or #69 in order to use new special telephone services.

Similarly, Part 68 makes no provision for new transmission methods such as Asynchronous Transfer Mode (ATM), Asymmetric Digital Subscriber Line (ADSL), or, until recently, Integrated Services Digital Networks (ISDN). Such techniques may be (and in fact are) employed in private networks. The FCC in late 1993 proposed to add ISDN to Part 68, but rules were only finally released 11 days ago, on March 7, 1996. See *Notice of Proposed Rulemaking in CC Docket No. 93-268*, 9 FCC Rcd 1068, adopted October 22, 1993.

As noted previously,[7] Congress has prohibited the Commission from applying Part 68 to open video networks. "Section 302(b)(3) of the conference agreement specifically repeals the Commission's video dialtone rules. Those rules implemented a rigid common carrier regime, including the Commission's customer premises equipment and Computer III rules, and thereby created substantial obstacles to the actual operation of open video systems." Joint Explanatory Statement of the Committee of Conference, at Section 653(c)(3).

The cable industry today is proceeding rapidly in digital technology and innovation. Deployment of digital video equipment has begun. First generation cable

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[7] See *supra*, p. 9.